ELECTRICAL WIRING PRACTICES

AG 130-R

UNIT OBJECTIVE

After completion of this unit, students will be able to understand basic electricity, understand basic electrical repairs, and exhibit safe wiring habits when working around electricity. This knowledge will be demonstrated by completion of assignment sheets and a unit test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES AND COMPETENCIES

After completion of this unit, the student should be able to:

1. Use approved safety measures in electrical wiring.
2. Make four different splices.
3. Repair an electrical cord.
4. Exhibit safe habits when working around electricity.
5. Complete wiring of light and convenience circuits.
6. Trouble shoot electrical circuits in a safe manner.

WIRE SPLICES

A. Wire Splicing Fundamentals

1. Definition of a Good Wire Splice

a. A wire splice is one wire connected to another wire.
b. The splice should be made so that it will conduct electricity as well as the unspliced wire.
c. The insulation applied over the splice should also be just as good as the insulation on the unspliced wire.

2. Splice Standards in the National Electrical Code

a. Connectors and splices must be enclosed in a junction box.
b. All splices or connections must be soldered or fastened with a solderless connector.
c. Splices with soldered connections must be wrapped with electrician's tape equivalent in an amount to the original insulation.

3. Cutting and Stripping Wires

a. If a knife is used to remove the insulation from the wire to be spliced, make sure the knife is sharp.
b. The knife blade should cut through the insulation at a 30-degree angle, and then moved parallel to the wire.
c. The blade should not be held at a 90-degree angle to the wire and run around the wire, for this may nick the wire.
d. The cut should leave the end of the insulation tapered.

4. Soldering Splices

a. Solder needs flux to help it stick to copper wires.

    1) Resin is a good flux for electrical soldering.
    2) Acid fluxes should not be used, because they are corrosive.

b. Use a resin-core, 50-50 (50% lead, 50% tin) solder that has a lower melting temperature than solder used in plumbing.
c. Place the soldering gun or soldering iron directly against the bare splice joint, keeping the wire on top of the iron.

d. When the wire is finally hot enough, apply the solder from above to the wire allowing it to flow into every opening between the turns of wire to insure good electrical conduction.

5. Replacing the Insulation with Plastic Electrician's Tape

a. Place the tape over the tapered end of the insulation and wind it spirally to the other end, allowing the turns to overlap a little.
b. Keep the tape tight so it will come together and seal out moisture and dirt.
c. Apply as many layers of tape as needed to build up the insulation to match what was taken off.

B. Four Common Wire Splices

1. End Splice (Western Union Splice)

a. The end splice is the most common type of small wire splice and is used to join two wires together so that the splice is as strong as the unspliced wire.
b. The end splice can be completed in six easy steps:

1) Remove about three inches of insulation from the ends of the two wires. Remember to make a tapering cut on the insulation.
2) Clean the exposed wire by scraping or sandpapering.
3) Halfway down the length of its exposed section, bend each wire 90 degrees and hook the two together at the bends.
4) Holding the wires securely with a pair of pliers, twist them in opposite directions around each other. Make sure the ends of the wires are wrapped as tight as possible so their sharp points will not cut through the tape insulation applied later.
5) Solder the splice to insure proper conduction of electricity.
6) Properly insulate the splice with electrical tape.

2. Tap or Branch Splice

a. A tap splice is used when one wire must be tapped into another wire somewhere other than its end.
b. The tap splice can be completed in six easy steps:

1) Remove at least two inches of insulation from the wire to which the tap is to be made.
2) Remove at least three inches of insulation from the end of the tap wire.
3) Clean the exposed wire by scraping or sandpapering.
4) Cross the wires holding them securely while the tap wire is wrapped tightly around the bare section of the other wire.
5) Solder the splice to insure proper conduction of electricity.
6) Properly insulate the splice with electrical tape.

3. Rat-tail Splice

a. The rat-tail splice is used on joints where there will be no strain on the wires, such as connecting wires in lighting fixtures, outlet boxes, and junction boxes.
b. A rat-tail splice can be completed in six easy steps:

1) Remove about two inches of insulation from the ends of the two wires to be spliced.
2) Clean the exposed wires by scraping or sandpapering.
3) Cross the wires holding them securely with a pair of pliers and twist them together.
4) Fold the sharp wire ends back along the twist to prevent a sharp point from cutting through the insulation tape.
5) Solder the splice or use a twist on solderless connector (which provides its own insulation) to insure proper conduction of electricity.
6) Properly insulate the splice if it is soldered.

4. Two-Conductor Cord Splice

a. This splice uses two staggered end splices to join twin conductors together.
b. It can be completed in six easy steps:

1) Remove about six inches of insulation from each end of the two conductors.
2) Clean the exposed wire by scraping or sandpapering.
3) Make two staggered end splices, one for each conductor.

a) The splices are staggered so that each splice is made alongside the insulation on the parallel conductor.
b) If the splices are made side by side, there would be the danger of a short, and the splice would be bulky.
c) Stagger the splices by cutting one wire of each set of conductors, three inches shorter than its parallel wire.
d) When making the splice, match the short end of one wire with the long end of the other conductor and join them.

4) Solder the splice to insure proper conduction of electricity.
5) Properly insulate the splice with electrician's tape.

ELECTRICAL CORD REPAIR

A. Electrical Cord Failure

1. Causes of Electrical Cord Failure

a. Electrical cords usually consist of an attachment plug and a two- or three-wire insulated conductor.
b. These wires are made of many fine strands of wire in order to make the cord flexible.
c. If these fine strands of wire are flexed too many times or become mechanically damaged, they will eventually break.
d. The cord's insulation will eventually break down from exposure to too much sunlight and heat.

2. Types of Electrical Cords and their Most Common Damage

a. Heater Cords

1) Heater cords are found on many tools such as branding irons, dehorning irons, soldering irons, and space heaters.
2) Intense heat and frequent use are the main causes of heater cord failure.

b. Service Cords

1) Service cords are found on lamps, power tools, and motors.
2) Service cord failure is due primarily to being flexed too many times or being coiled too tightly around a warm machine.
3) Most of the damage occurs near the attachment plug or where the cord enters the machine.

c. Extension Cords

1) Extension cords are used extensively in agriculture to provide a temporary, flexible extension of an electrical circuit.
2) Extension cord failure occurs primarily from insulation and plug damage.

B. Repair Procedures

1. Removing a Plug from a Cord

a. Remove the cord from the tool or motor and the convenience outlet.
b. Remove the screws holding the plug together and open the shell slowly, observing the position of the wires and terminal clips.
c. Push the cord protector back over the cord.
d. Loosen the screws on the terminal clips and remove the wires.
e. Examine the plug body and terminal clips for damage.

1) A burned, discolored, broken, or cracked plug body should be replaced.
2) Terminal clips that have lost their spring due to heat should be replaced because they will make poor contact.

2. Repairing the Cord

a. Remove all the burned, charred, brittle, or discolored insulation.

1) Cut the cord back to the point where the insulation of the wires is good.
2) Make sure that the wires are cut to the same length.

b. Remove the appropriate amount of outer cord jacket by placing the ends of the wires in the plug channels to determine how much.
c. Remove the insulation from the individual wire ends just enough to hook around the terminal screws.
d. Clean the bare wires of any foreign material by scraping and then twist the strands together tightly.

3. Attaching a Plug to a Cord

a. Tie a holding knot (the Underwriters' knot) in the exposed, insulated wires where they extend from the outer cover.
b. Loop the bare ends of the wires so they may be properly attached to the screw terminal clips.
c. Wrap the wires around behind the prongs to better withstand pulls on the cord.
d. Place the looped wire end well under the screw heads and avoid fraying when tightening the screws.
e. Place each screw terminal clip in its proper position in the plug.
f. Replace the cord protector in the appropriate slot in the plug.
g. Replace the other half of the plug slowly.
h. Replace the screws that hold the plug together.

4. Attaching a Lamp Socket to a Cord

a. Remove the cap from the socket, usually by pressing at a designated point on the socket and prying.
b. Insert the end of the cord through the cap and tie the holding knot.
c. Strip the insulation from the ends of the wires and attach them to the terminal screws without fraying the wires.
d. Replace the cap onto the socket, making sure that the insulating bushing in the top of the cap and the insulation inside the shell are both in good condition and in place.

SIMPLE CIRCUIT INSTALLATION

A. Fundamentals of Electric Circuits

1. Circuit Terms

a. Simple Circuit -- A simple circuit is a complete circle of current flow. It consists of a source of electricity, one wire to carry the current from the source to where it will be used, and another wire to carry it back, plus an object of rated resistance (for example, a lamp) to use the voltage.
b. Branch circuit--Branch circuits are circuits beginning from the service entrance panel and branching out into a variety of places for a variety of purposes.
c. Open circuit--An open circuit refers to a break in the circuit circle so that the current cannot flow through it.
d. Short circuit--A short circuit is a current flow around the circuit resistance and back to the source so rapidly that fuses blow, wire insulation burns, and batteries drain.
e. Grounding--Grounding is the practice of providing an additional connection between a piece of electrical equipment and the earth with a conductor called a ground wire in case the current gets out of the circuit.

2. Components of a Simple Two-wire Circuit

a. Wires--A simple circuit has a white wire and a black wire.

1) The white wire is known as the neutral or grounded wire because it is always connected to an underground water pipe or a ground rod through the service-entrance panel.

a) It must always run direct to every 120-volt outlet.
b) It must always be connected to a neutral terminal (silver-colored).
c) It never has a fuse or breaker.
d) It never has a switch.
e) It must be electrically continuous.

2) The black wire is referred to as the "hot" wire.

a) One black wire and one white wire must run to every outlet.

b) Electrical potential always exists between the black wire and the white wire.

b. Electrical Boxes--These are boxes made of either metal or plastic, rectangular or octagonal in shape, which have the following functions:

1) They anchor the cable or conduit so stress cannot be placed on wire connections.
2) They are nailed, screwed, or clamped to the building in order to support outlets, switches, or fixtures.
3) They contain all wire connections made outside of fixtures.

c. Outlets--The most common outlet is the duplex receptacle wired so that both of its outlets are on the same circuit.

1) Outlets are wired across the black wire and the white wire.
2) The current enters the outlet on the black wire, flows from one screw through a metal strap to the other screw, and continues on to the next electrical box.
3) One outlet in a duplex receptacle may be switched by breaking the metal strap between the two screws, but they must be on the same circuit breaker.

d. Fixtures--They are bases or housings for light bulbs, fan motors, and other such electrical devices.

e. Switches--They are electrical devices which provide a means to open a circuit to stop electron flow to outlets or lights and to close it again to allow current flow.

1) The wire is usually black except in a switch loop.
2) Their amperage and voltage ratings must match those of the circuit.
3) Their number of poles indicates how many hot wires feed through the switch.
4) Their number of throws indicates from how many locations a switch can be operated.

f. Overcurrent Protection Devices--Fuses and breakers are always wired to the black (hot) wire.

g. Entrance Switch--It is a switch placed ahead of the fuse in the hot wire where electricity enters the building.

3. Colors of Wires and Terminals in Structural Wiring

   a. Colors of Wires

      1) White (sometimes natural gray) colored wire must be used only for the ground wire.
      2) Additional grounding conductors may be green, green with one or more yellow stripes, or a bare wire.
      3) Wiring for the "hot" wires may be any other color but it is most frequently black or red.
      4) The color schemes most often used for structural wiring are:

         a) Two wire circuit - white and black
         b) Three wire circuit - white, black, and red
         c) Four wire circuit - white, black, red, and blue
         d) Five wire circuit - white, black, red, blue, and yellow

   b. Colors of Terminals on Electrical Equipment

      1) Natural copper or brass terminals are for "hot" wires only.
      2) Terminals of a whitish color (such as nickel, tin, or zinc-plated) are for grounded wires only.
      3) Terminals of a green color are for grounding wires only.

         a) Grounding wires are those connected to the surface or shell of an appliance or tool to supply a continuous low resistance path to ground should the surface of the tool or appliance accidentally become energized

B. Wiring a Convenience Circuit

1. Wiring Boxes with 12-2 G Romex Cable:

   a. Fasten the boxes securely to the framing.
   b. Drill holes in the framing through which the cable is to be pulled.
   c. Run the cable between the boxes and secure them with staples within 12 inches of the boxes.

d. Prepare the cable for insertion into the boxes by slitting 6 to 8 inches of the outside cable covering (jacket) with a knife or cable ripper.
e. Separate the wires from the ripped jacket and cut off the excess jacket material.
f. Insert the ends of each cable through a knockout hole in a box leaving six inches extending from the box.
g. Tighten the cable clamp to secure the cable to the box with 1/16 inch of the cable jacket extending into the box beyond the clamp.

2. Wiring a Duplex Receptacle

a. Remove about 3/4 inch of insulation from the ends of the black and white wires extending from the box. Use a knife or wire stripper, but do not nick the wires.
b. Make a round loop in the end of each wire with needle-nose pliers.
c. Wrap the loops of the black wires around the brass colored screws of the receptacle in the direction the screw turns, and then tighten the screws.
d. Wrap the loops of the white wires around the silver colored screws of the receptacle in the direction the screw turns, and then tighten the screws.
e. Wrap the loop of the bare wire around the green screw of the receptacle in the direction the screw turns, and then tighten the screw.
f. If a second bare wire from another cable is in the same box, secure it to the other bare wire with a special metal crimp clamp or a solderless connector.
g. Secure the receptacle with the screws provided and install the receptacle box cover.

C. Wiring a Light Circuit

1. Wiring a Light Fixture Between the Source and the Switch

a. Strip 5/8 inch insulation from the ends of all the wires in the octagonal junction box to prepare them for connection with wire nuts (solderless connectors).
b. Strip 5/8 inch of insulation from both ends of an 8-inch length of green wire and ground it to the box with a ground screw.

c. Bundle the four ground wires together and twist a wire nut onto the four wire ends.
d. Mark the white wire coming from the switch with black tape to identify it as a hot wire.
e. Attach the black wire from the switch to the brass colored terminal of the light fixture.
f. Strip 5/8 inch of insulation from both ends of an 8-inch length of white wire and attach one end to the silver colored screw of the light fixture.
g. Connect the loose ends of the three white wires with a wire nut.
h. Connect the ends of the remaining black wires--including the white wire wrapped in black tape--with a wire nut.

2. Wiring a Single Pole, Single Throw Switch for the Light Above

a. Remove about 3/4 inch of insulation from the ends of the black and white wires running to the switch from the light.
b. Make a round loop in the end of each wire with needle-nose pliers.
c. Wrap black tape around the white wire to identify it as a black or hot wire.
d. Wrap the loops of the black wires around the brass colored screws of the receptacle in the direction the screw turns, and then tighten the screws.
e. Attach the bare ground wire to the box with a ground screw.
f. Secure the switch in the box with screws provided and install the switch cover.

TESTING ELECTRIC CIRCUITS

A. Types of Electrical Circuit Testers

1. There are two general types of electrical test meters:

a. Digital - Meter displays numbers when measuring volts, ohms, amperes, or other electrical measurements.
b. Analog - Meter uses a needle to indicate measurement reading of volts, ohms, amperes, or other electrical measurements.

2. Types of Electrical Test Devices

a. Ammeter

1) Measures the flow of current in an electrical circuit.
2) Units of measurement are amperes or milliamperes (milliamps).
3) The meter must be installed in the circuit in series in order to measure current properly.
4) Clamp over ammeters are also available.

b. Voltmeter

1) Measures the potential of electricity in a circuit.
2) Units of measurement are volts.
3) The meter must be installed in the circuit in parallel in order to measure voltage properly.

c. Ohmmeter

1) Measures the resistance of a circuit component or circuit section.
2) Units of measurement are ohms.
3) The meter must be installed in the circuit in parallel across the component or circuit section for which the resistance is to be measured. For accurate reading, remove the component from the circuit and measure.
4) It is important that the circuit not be energized (i.e., no current should be flowing through the circuit) when the measurement is being made.
5) An ohmmeter should be calibrated with each use and with each change of meter scale.

d. Multitester

1) A meter with variable scales capable of measuring volts and ohms and additionally giving an audible indication of circuit continuity.

e. Multimeter

1) A meter with variable scales capable of measuring volts, ohms, and milliamperes and additionally giving an audible indication of circuit continuity.

f. Test Light

1) A light bulb with two wires attached can serve as a test light.
2) It can be used to troubleshoot circuits for shorts, opens, grounds, and voltage.
3) When connected in series in a circuit, the light bulb lights to indicate presence of current.

g. Continuity Test Light

1) This is similar to a test light except that it contains a battery along with a light bulb.
2) It can be used to troubleshoot circuits for shorts, opens, grounds, and voltage.
3) The continuity test light will "light" whenever it is connected to both ends of a circuit wire that has "continuity," i.e., is not broken.

h. Three-prong Circuit Tester

1) This is a commercially available device that plugs into the outlet of the circuit.
2) A three-prong circuit tester indicates:

a) Correct wiring
b) Open ground
c) Reverse polarity
d) Open neutral
e) Hot and ground wire reversed

B. Troubleshooting Electric Circuits with a Test Light

1. Short Circuits

a. A short circuit occurs when direct contact is made between the two wires of a circuit or some other part which is conducting electricity as a result of damage or failure of the insulation.
b. When a short circuit occurs, the fuse or circuit breaker will open the circuit.
c. An ohms meter or a test light can be used to locate short circuits.

2. Open Circuits

a. Sometimes "opens" or breaks in electrical connections in appliances will occur. These most generally occur in the cord near a point where the cord enters the electrical device.
b. When an open occurs, the machine or appliance will not operate. However, before assuming the problem is an open, check to make sure that the attachment plug is making good contact with the convenience outlet.
c. The test lamp may be used to locate opens.

1) Connect the clips on the test lamp to the terminals of the electrical device. Most likely the casing or a portion of it will have to be removed from the device.
2) Plug the attachment cord on the test lamp into a convenience outlet and turn the appliance on. If the device operates, the open exists in the service cord. If, it still does not operate, the open is in the switch or some other part of the device.

3. Accidental Grounds

a. An accidental ground or grounding fault can occur when insulation becomes damaged or is removed by some cause. The conductor can then electrically charge that with which it makes contact. If a person touches the electrically charged part, the electron flow travels through him to the ground.
b. To prevent accidental grounds, manufacturers often attach a ground wire to the frames of tools, appliances, and machines. If the frame is accidentally charged, the electron flow will travel to the ground through the ground wire.
c. The test lamp may be used to check for accidental grounds.

1) Disconnect the device being tested and insulate it from the ground.
2) Attach one of the clips on the test lamp to one of the flat prongs (not the round prong) on the attachment plug of the device being tested and the other clip to the frame of the device.
3) Plug in the test lamp. If the bulb glows, the frame of the appliance is electrically charged and can cause a serious accident.

4) Each appliance that has been repaired should be checked for accidental grounds before being returned to the owner or to use.

4. The test lamp may be used for other purposes.

a. The test lamp may be used to determine whether an outlet is 120 or 240 volts. The 240-volt lamp in the test lamp will glow brightly if the circuit is 240 and dimly if 120.
b. The test lamp can be used to determine whether an outlet is properly grounded for the use of equipment grounds.

1) Use a pigtail socket and a 240-volt bulb. Hold one of the leads on the metal screw, holding the cover plate in place, and the other lead in one or the other of the slots in the outlet.
2) The test lamp will glow when the lead to the outlet is in the slot connected to the fuse or breaker back at the panel if the outlet is grounded.

ACTIVITY:

1. Diagram an outlet and a light switch. (130R-22)
2. Diagram a three-way switch light circuit. (130R-20)
3. Practice doing each of the four different splices
4. Repair a heater or service cord.
5. Make an extension cord.
6. Wire a convenience and light circuit.
7. Have students wire the circuit they diagramed and then test their wiring with an outlet tester.

Special Material and Equipment:

Electrician's pliers, knife, solid single 14 gauge wire, soldering iron, 50-50 resin-core solder, electrician's tape, Screwdriver, pocket knife, cords, extra plugs.
Hand tools suitable for electrical wiring, cable ripper, wire stripper, 14-2 w\g cable, switch box, octagon box, single-pole switch, three-way switch, porcelain lamp holder, duplex receptacle, switch cover, outlet cover, wire nuts, test light, voltage meter.

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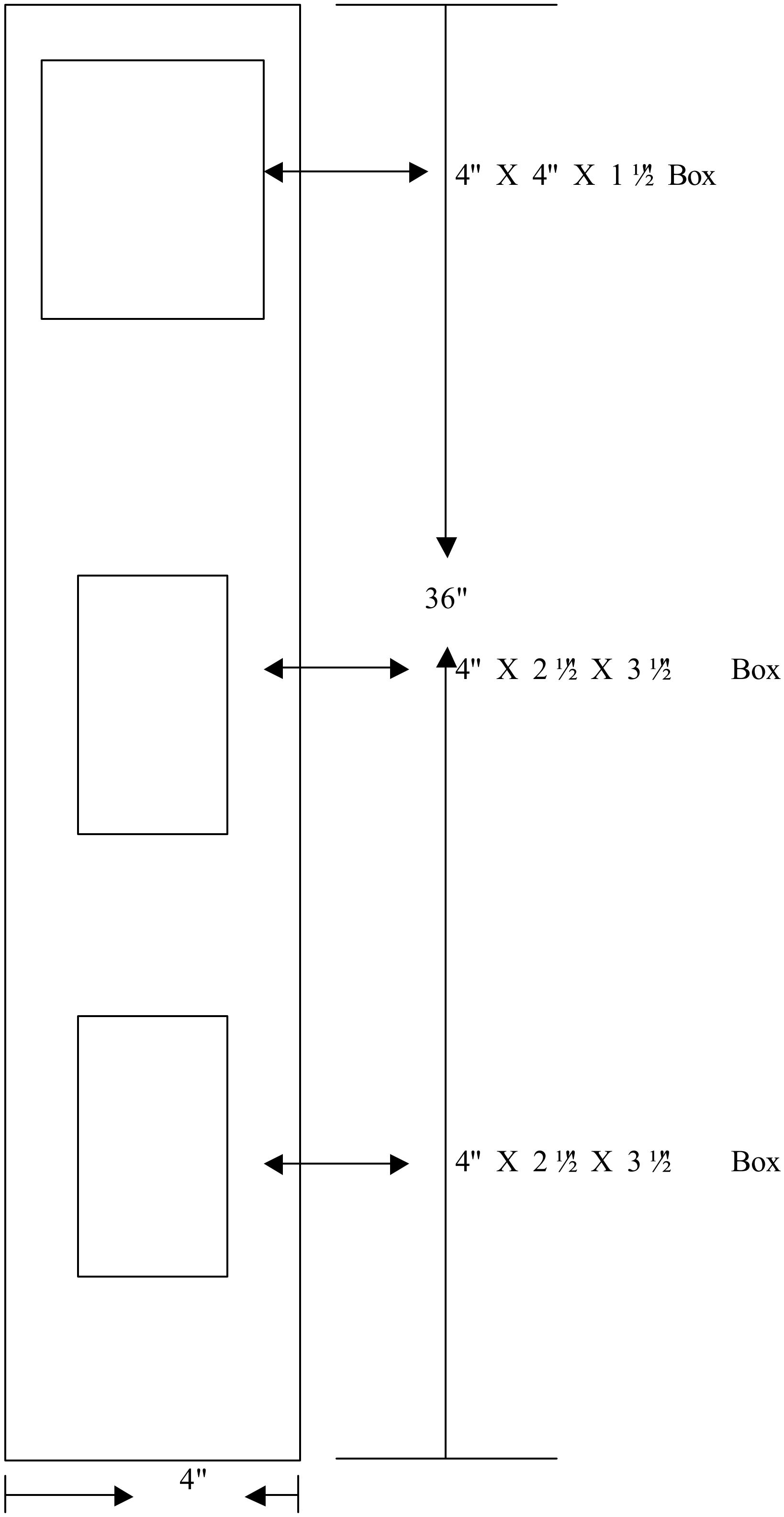
McReynolds, Ray (1997) STEP BY STEP GUIDE BOOK ON HOME WIRING, Step-By-Step Book Co. Salt Lake City, Utah 1-800-678-1500

WIRING PROJECT BOARD



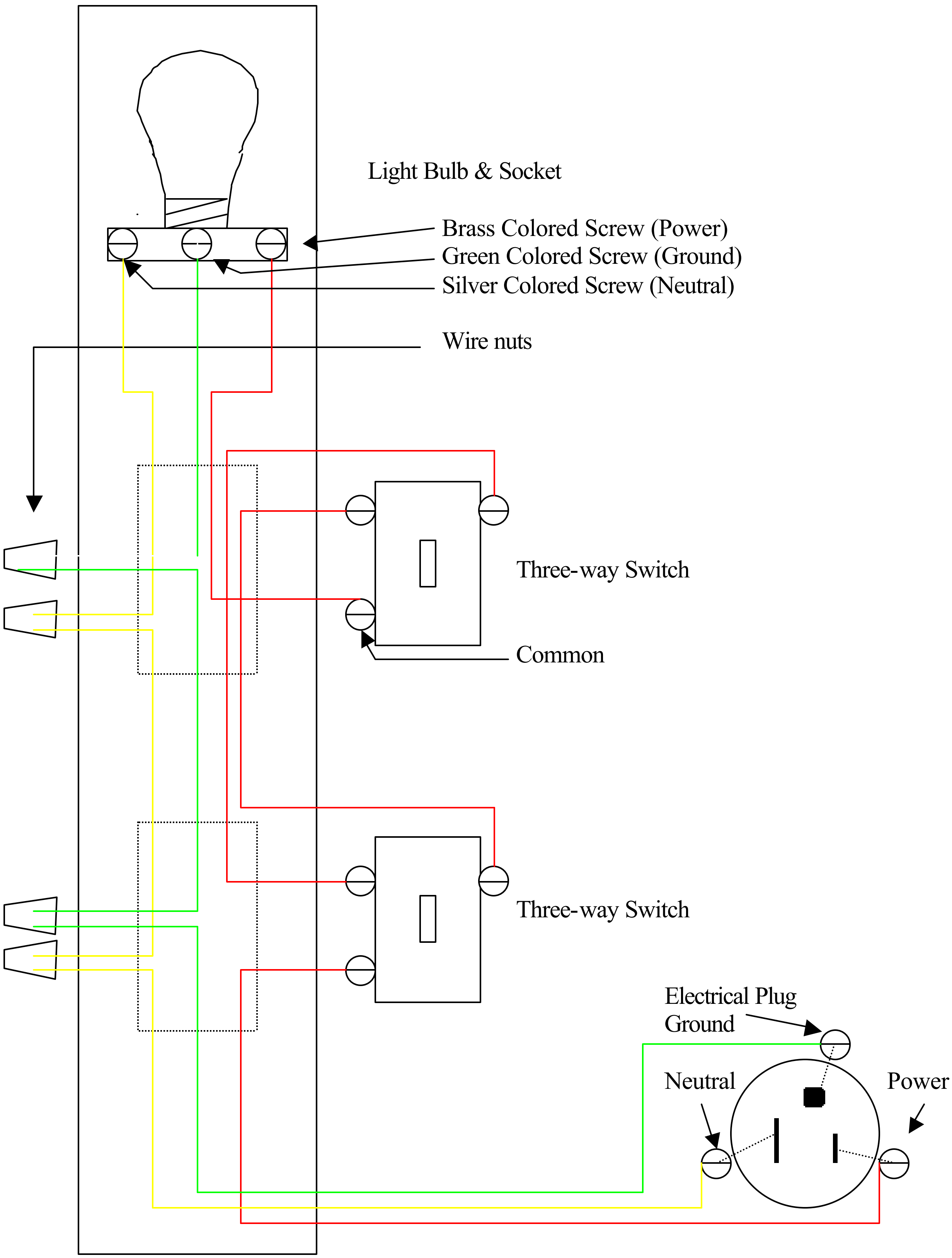
Using 1" X 4" lumber for the board, fasten junction boxes to the board using ½ wood screws.

Using romex cable to wire the boxes with any combination of outlets, switches, and a light at the end.

Have students use the drawing on the next page to draw out the wiring before wiring the junction boxes.

Use a grounding screw in all metal boxes

WIRING PROJECT- THREE-WAY SWITCH



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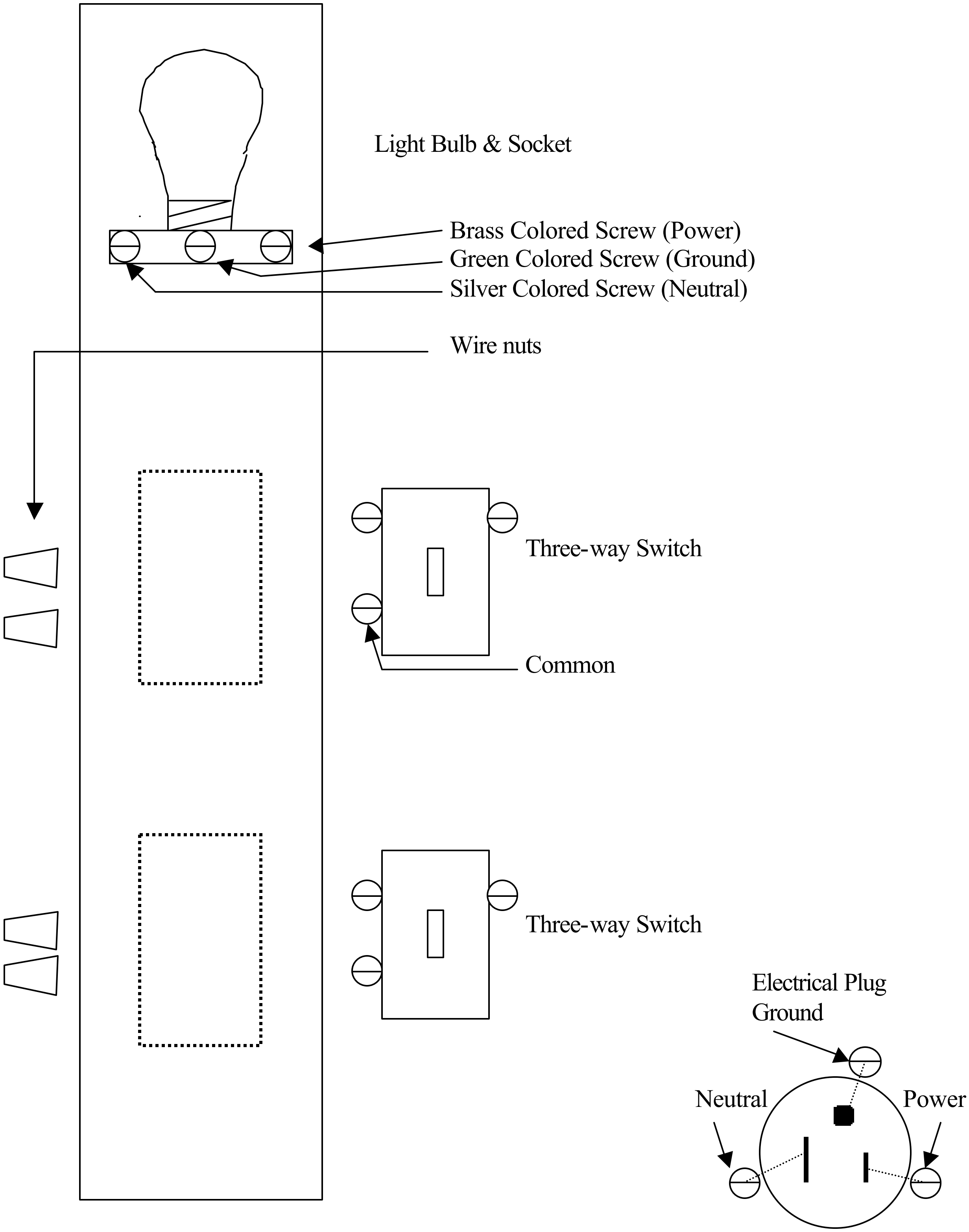
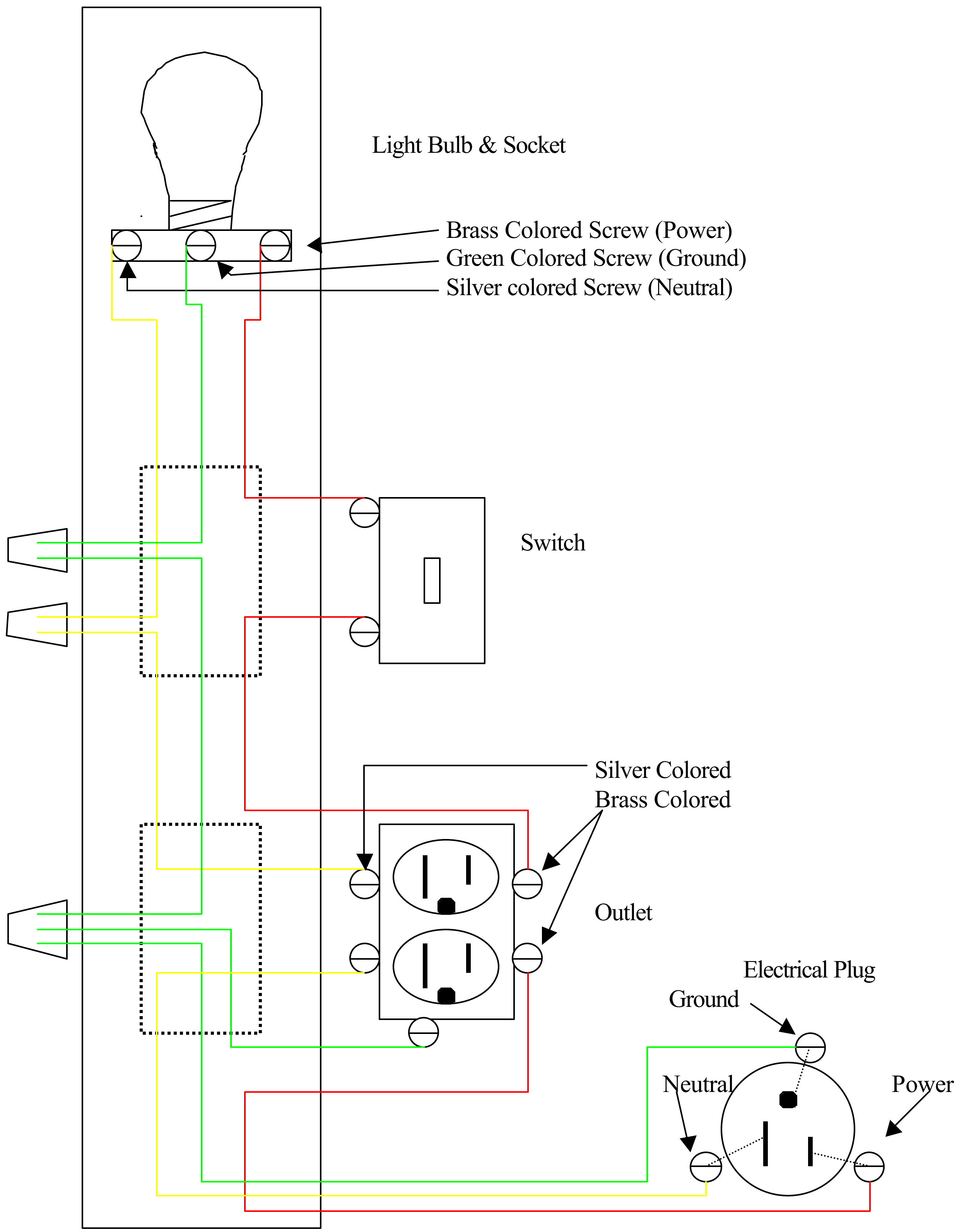
Date___________________

WIRING PROJECT- THREE-WAY SWITCH Score______



WIRING PROJECT – OUTLET & SWITCH



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WIRING PROJECT – OUTLET & SWITCH

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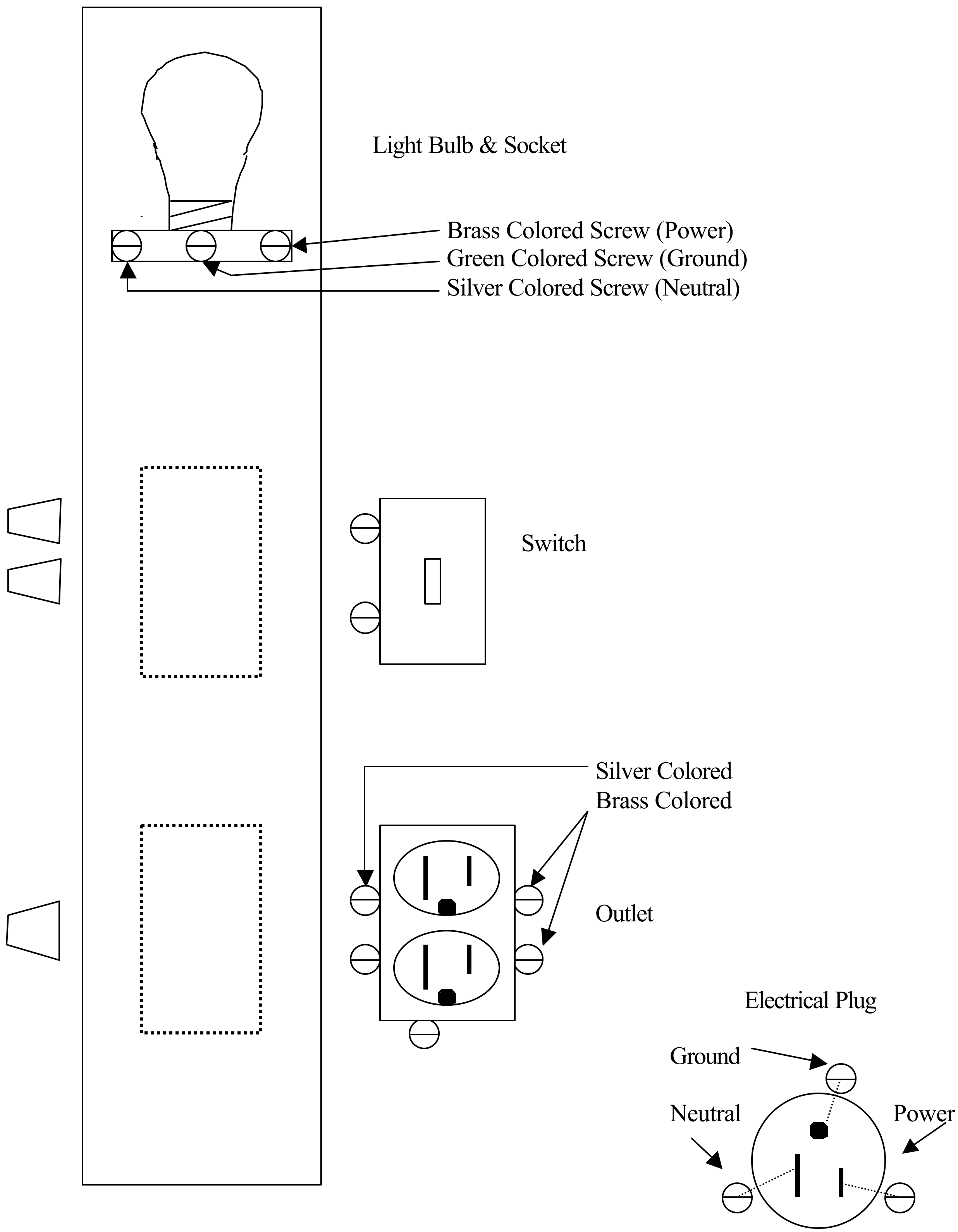

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UNIT EXAM
INTROUDCTION TO ELECTRICTY AND ELECTRICAL WIRING PRACTICES

Questions 1 – 20 are true or false questions, circle T for true and F for false.

1. T or F Some form of electricity is present in all matter.
2. T or F Electrons carry a positive electrical charge and orbit around the center of the atom.
3. T or F When free electrons move randomly from atom to atom, their energy is small.
4. T of F The speed of electric current is greater than the speed of light.
5. T or F Fuses or breakers with an amperage larger than the wire's rated current amperage will not protect the circuit from overheating.
6. T or F Stranded wire improves flexibility.
7. T or F Electricity travels on the outer surface of the wires.
8. T or F Aluminum conductors require one wire size larger than copper wire to provide the same load.
9. T or F The Cable marking, 12-2 w/g, indicates that the cable has one black 12 gauge wire and one white 12 gauge wire and is water resistant guaranteed.
10. T or F Electrical cable is generally used for permanent indoor installation.
11. T or F In electrical work, e.m.t. stands for emergency medical treatment.
12. T or F Type THWN wire is only used in dry locations with high temperatures.
13. T or F A wire splice cannot be expected to conduct electricity as well as the unspliced wire.
14. T or F When stripping a wire with a knife, the knife should be held a 90-degree angle to the wire and run around the wire to cut the insulation.
15. T or F When replacing insulation with plastic electrician's tape, it should be wrapped around until the layers equal the thickness of the insulation removed.
16. T or F The neutral wire is attached to an electrical switch in a circuit.
17. T or F The black or red wire is the hot wire in an electrical circuit.
18. T or F A circuit test light can be made from a pigtail light socket.
19. T or F A 220 volt circuit has two 110 volt hot wires.

20. T or F Bulbs of different wattage can be installed in a homemade, pig-tail socket, test light to test circuit voltage.

B. Matching, write in the correct letter

1. _____ A break in the circuit so that the current cannot flow	a. watt
2. _____ A measure of electron flow	b. fault
3. _____ A measure of electrical power	c. insulator
4. _____ A measure of electrical pressure	d. short
5. _____ A material through which electrons can flow freely	e. ampere
6. _____ A material that provides great resistance to electron flow	f. grounding
7. _____ A measure of resistance	g. U.L.
8. _____ Electrons not readily moved from their orbits	h. end splice
9. _____ A direct connection between a hot wire and a ground connection	i. volt
10. _____ A leakage of current from a hot wire to a ground connection	j. conductor
11. _____ Abbreviation of the name of an organization that tests electrical products for safety	k. ohm
12. _____ Used to join two wires together so the joint is as strong as the unspliced wire	l. planetary
13. _____ Used when one wire must be tapped into another at some point other than at its end	m. open circuit
14. _____ Used to join wires where there will be no strain	n. branch splice
15. _____ Providing an additional connection between a piece of electrical equipment and the earth	o. rat-tail splice

C. Multiple Choice, circle the correct answer

1. Which symbol in the equation, A = V/R (Ohm's Law), is not defined properly below?

a. A equals insulation in amperes.
b. V equals potential energy in volts.
c. R equals resistance in ohms.
d. None of the above.

2. At which level of amperage does a fatal shock usually occur?

a. 5 amps
b. 10 milli amps
c. 15 milli amps
d. None of the above.

3. Which copper wire gauge size has the wrong ampere rating?

a. No. 14, rated for 15 ampere circuits.
b. No. 12, rated for 20 ampere circuits.
c. No. 10, rated for 25 ampere circuits.
d. None of the above.

4. Which item listed below is not a part of a simple circuit?

a. A hot wire and a neutral wire.
b. Electrical boxes and outlets.
c. Fixtures and switches.
d. A voltage transformer.

5. 110V overcurrent protection devices are connected to which wire in a circuit?

a. Black
b. White
c. Green
d. Bare

6. To which terminal screw on a 110V duplex outlet is the black wire connected?

a. Silver or white
b. Gold or yellow
c. Green
d. None of the above.

7. A simple three-prong outlet tester can test all but which of the following?

   a. Open ground
   b. Hot and ground wire reversed
   c. Open neutral
   d. Circuit voltage

8. Which of the following is the best conductor of electricity?

   a. aluminum
   b. copper
   c. silver
   d. iron

9. Which of the following materials is not a good insulator?

   a. glass
   c. plastic
   c. rubber
   d. oily leather

10. Since one watt is equal to one volt pushing one ampere through a conductor (W = VA), how many watts would be produced by 110 volts pushing 10 amperes?

   a. 11W
   b. 120W
   c. 1,100W
   d. 11,000W

ANSWER SHEET

A. True and False

1. t
2. f
3. t
4. f
5. t
6. t
7. t
8. t
9. f
10. t
11. f
12. f
13. f
14. f
15. t
16. f
17. t
18. t
19. t
20. t

B. Matching

1. m
2. e
3. a
4. i
5. j
6. c
7. k
8. l
9. d
10. b
11. g
12. h
13. n
14. o
15. f

C. Multiple Choice

1. a
2. b
3. c
4. d
5. a
6. b
7. d
8. c
9. d
10. c